

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1]A plate spring for safeguards which has a hole and plugged up this hole with a sheet.

[Claim 2]A plate spring for the safeguards according to claim 1 whose sheet is a metallic foil.

[Claim 3]A sheet of a metallic foil, and a plate spring for the safeguards according to claim 2 which made a synthetic resin layer intervene between plate springs.

[Claim 4]A plate spring for the safeguards according to claim 1 which consists of bimetal which laminated each metal layer which has each different coefficient of thermal expansion.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the suitable plate spring for safeguards for the safeguard for preventing explosion of a rechargeable battery, for example.

[0002]

[Description of the Prior Art]In recent years, a demand called an improvement of the heavy loading characteristic of the rechargeable battery used as a power supply and the densification of energy is becoming strong with the spread of a video camera, a headphone stereo cassette tape recorder, portable telephones, etc. Although the nickel KADONIUMU cell used conventionally can be mentioned as a rechargeable battery which fills this demand, these days, a lithium cell attracts attention and development and use of this lithium cell are activating.

[0003]Generally this kind of rechargeable battery is sealed type structure. For this reason, if a power generation element generates heat and gas is emitted from this power generation element by overcharge, a short circuit, etc., the pressure within a cell case will rise and degradation of battery capacity will be caused. It may result in explosion of a cell case, and surrounding apparatus is damaged or harm is inflicted on the surrounding person.

[0004]In order to prevent such an accident, the safeguard is formed in this kind of rechargeable battery. For example, there are what inserted in the energizing route of this cell the PTC board (it has the characteristic that resistance increases rapidly when the temperature defined beforehand is exceeded), a thing which inserted in the energizing route the switch which switches with the pressure in this cell, etc. Or there are some which compounded these and improved safety and this compounded thing is more common.

[0005]

[Problem(s) to be Solved by the Invention]However, although safety increased when several kinds of safeguards were compounded, there was a problem referred to as causing complication of structure and the jump of cost.

[0006]Then, there is a technical problem of this invention in providing the plate spring for safeguards which enables composite of two kinds of safeguards, without being accompanied by complication of structure.

[0007]

[Means for Solving the Problem]In order to solve an aforementioned problem, a plate spring for safeguards of this invention has a hole, and plugs up this hole with a sheet.

[0008]For example, when applying this plate spring to a safeguard of a rechargeable battery, it arranges so that this plate spring may be reversed in response to a pressure in this cell, and a normally closed switch which carries out Kaisei by reversal of this plate spring is inserted in an energizing route of this cell. A gas path from which gas in this cell escapes through a hole of this plate spring is formed. In such a structure, since a plate spring will be reversed and a switch will

carry out Kaisei in connection with this if gas is emitted from a power generation element of a cell and a pressure in this cell rises by overcharge, a short circuit, etc., an energizing route of this cell is disconnected and current is intercepted. And if a pressure in a cell continues rising in spite of interception of this current, a sheet of a hole of a plate spring will be torn and gas in a cell will be discharged outside through a gas path. Thereby, a pressure in a cell declines and cell bursting is prevented.

[0009] That is, since a plate spring of this invention achieves two kinds of duties called a change of a switch, and discharge of gas, it can simplify structure of this safeguard.

[0010] As a sheet which plugs up a hole of a plate spring, there is a metallic foil, for example. When this metallic foil closes a hole of a plate spring, in order to prevent an electric corrosion generated between a metallic foil and a plate spring, it is preferred to make a synthetic resin layer intervene among both.

[0011] A thing of bimetal may be applied as a plate spring. Also when applying a plate spring of this bimetal to a rechargeable battery, a normally closed switch which carries out Kaisei by reversal of this plate spring is inserted in an energizing route of this cell, and a gas path from which gas in this cell escapes through a hole of this plate spring is formed. In such a structure, if a power generation element of this cell generates heat by overcharge, a short circuit, etc., a plate spring will be reversed, a switch of an energizing route will carry out Kaisei, and current will be intercepted by this heat. And if a power generation element of a cell continues generating heat and a pressure in a cell continues rising in connection with this in spite of interception of this current, a sheet of a hole of a plate spring will be torn, gas in a cell will be discharged outside, and cell bursting will be prevented.

[0012]

[Embodiment of the Invention] Hereafter, this embodiment of the invention is described with reference to an accompanying drawing.

[0013] Drawing 1 and drawing 2 show a 1st embodiment of the plate spring of this invention. This plate spring 1 laminates the main part 2 of a plate spring, the synthetic resin film 3, and the aluminum foil 4 made from stainless steel one by one, and plugs up the hole 2a of the center of this main part 2 of a plate spring with the synthetic resin film 3 and the aluminum foil 4.

[0014] The synthetic resin film 3 intervenes between the main part 2 of a plate spring, and the aluminum foil 4, and achieves the duty which prevents the electric corrosion produced between dissimilar metals.

[0015] Although laminating is only available for the synthetic resin film 3 and the aluminum foil 4, when it may paste up and pastes them up, they use welding by the solvent of the synthetic resin film 3, or heating, or adhesives are used for them. As shown in drawing 3, each synthetic resin films 5 and 6 may be laminated to both sides of the aluminum foil 4, and this aluminum foil 4 may be covered.

[0016] Or aluminum foil may be formed in one field of a synthetic resin film by metal deposition. After vapor-depositing aluminum foil to one field of a synthetic resin film, other synthetic resin films may be laminated and aluminum foil may be inserted between the synthetic resin films of two sheets.

[0017] Synthetic coating material and adhesives may be applied to one side of aluminum foil, the field of these synthetic coating material and adhesives may be laid on top of the main part 2 of a plate spring, and aluminum foil and the main part of a plate spring may be pasted up. Synthetic coating material and adhesives may be applied to both sides of aluminum foil.

[0018] Of course, the thing of the metal of other kinds may be applied as construction material of a plate spring or a metallic foil.

[0019] Under environment which the construction material of the main part 2 of a plate spring and the construction material of the metallic foil which plugs up the hole 2a of this main part 2 of a plate spring are not the same, or an electric corrosion does not generate, when using this plate spring 1, a synthetic resin film may be omitted and direct lamination of the main part 2 of a plate spring and the metallic foil may be carried out. Aluminum foil is omitted and only a synthetic resin film is not cared

about.

[0020]Now, such a plate spring 1 is applied to the safeguard 12 of the rechargeable battery 11 as shown in drawing 4. In this rechargeable battery 11, the power generation element 13 is closed to the cell case 14, and the safeguard 12 is supported by caulking processing which made the insulator 15 placed between the upper beds of this cell case 14.

[0021]This safeguard 12 piles up the gasket 18, the plate spring 1, the spacer 19, the PTC board 21, the annular terminal 22, and the insulating seal 23 one by one inside the conductor case 17, as shown in drawing 5. After inserting the moving piece 24 in the hole of the PTC board 21 and the annular terminal 22, the electrode lid 26 which welded the contact piece 25 by resistance on this is put, the periphery of the conductor case 17 is crimped and processed, the insulating seal 23 is made to intervene and the periphery of this electrode lid 26 is put.

[0022]If the temperature defined beforehand is exceeded, the PTC board 21 is a positive thermistor with the characteristic that resistance increases rapidly, and although it is low resistance at ordinary temperature, it is formed for improvement in safety so that it may state later.

[0023]The hole 17a is formed in the bottom of the conductor case 17. The plate spring 1 has faced the inside of the rechargeable battery 11 via the hole 17a of this conductor case 17. The terminal 29 is hung down and moved back to the periphery of this hole 17a, and this terminal 29 is connected to the power generation element 13 through the lead 30.

[0024]The contact piece 25 of the electrode lid 26 has sufficient elasticity, and the tip touches the annular terminal 22.

[0025]the energizing route of this safeguard 12 -- terminal 29-> of the power generation element 13 -> lead 30 -> conductor case 17 -- it is called the spacer 19 ->PTC board 21 -> annular terminal 22 -> contact piece 25 -> electrode lid 26.

[0026]In such composition, if it will be in overcharge or a short condition and an over-current flows, the PTC board 21 of the above-mentioned energizing route will generate heat, and resistance of this PTC board 21 will become very large. By this, an over-current is controlled, current becomes small, and overcharge or a short condition is avoided.

[0027]If gas is emitted from the power generation element 13, the pressure within the cell case 14 rises and a permissible level is exceeded in spite of control of an over-current with this PTC board 21, as shown in drawing 6, the plate spring 1 is reversed, the rear face of this plate spring 1 will swell, and the moving piece 24 will be pushed up by this pressure. In connection with this, the tip of the contact piece 25 is also pushed up and this tip estranges from the annular terminal 22. As a result, the above-mentioned energizing route is disconnected and current is intercepted.

[0028]In this way, in spite of having intercepted current, when gas continues being emitted from the power generation element 13 and the pressure within the cell case 14 continues rising, As shown in drawing 7, the synthetic resin film 3 and the aluminum foil 4 of the plate spring 1 are torn, and the gas within the cell case 14 results inside the electrode lid 26 from the hole 2a of the center of the main part 2 of a plate spring, and is emitted outside from the hole 26a of this electrode lid 26.

Thereby, explosion of the cell case 14 is prevented.

[0029]That is, in this rechargeable battery 11, the operation of Mie called discharge of the inner gas by destruction of control of an over-current with the PCT board 21, cutting of the energizing route by reversal of the plate spring 1, the synthetic resin film 3, and the aluminum foil 4 is performing explosion protection of this rechargeable battery 11.

[0030]Two things in an operation here of this Mie, i.e., the operation called cutting of an energizing route, and the operation called discharge of inner gas originate in operation of the one plate spring 1. If it puts in another way, this plate spring 1 has achieved two duties simultaneously. This enables simplification of the structure of this safeguard 12.

[0031]Drawing 8 shows other examples of the safeguard which applied the plate spring 1 shown in drawing 1 and drawing 2. This safeguard 31 piles up the gasket 33, the plate spring 1, the PTC board 34, the annular terminal 35, and the insulating seal 36 one by one inside the conductor case 32, and

puts the periphery of the contact piece 38 between the insulating seal 36 and the electrode lid 37, This electrode lid 37 is put, the periphery of the conductor case 32 is crimped and processed, the insulator 39 is made to intervene and the periphery of this electrode lid 37 is put.

[0032]The contact piece 38 of the electrode lid 37 has the annular piece 38a and the ligula 38b, as shown in drawing 9, it sandwiches the annular piece 38a between the insulating seal 36 and the electrode lid 37, and is contacting the ligula 38b for the annular terminal 35. A hole is formed in the ligula 38b of this contact piece 38, and the spring aggressiveness 41 is pressed fit in this hole. This spring aggressiveness 41 has the head 41a and the two legs 41b, as shown in drawing 10, and it makes the gap of these legs 41b larger than the diameter of the hole 2a of the main part 2 of a plate spring.

[0033]This safeguard 31 is also applied to the rechargeable battery 11 shown in drawing 4, and that energizing route says it as the terminal 42 → PTC board 34 → annular terminal 35 → contact piece 38 → electrode lid 37 of the power generation element 13 → lead 30 → conductor case 32.

[0034]Here, if it will be in overcharge or a short condition and an over-current flows, the PTC board 34 of the above-mentioned energizing route will generate heat, the resistance will become very large, and overcharge or a short condition will be avoided.

[0035]If the pressure within the cell case 14 rises and a permissible level is exceeded in spite of control of this current, as shown in drawing 11, the plate spring 1 will be reversed, and this plate spring 1 will thrust up each leg 41b of the spring aggressiveness 41. In connection with this, the tip of the contact piece 38 estranges from the annular terminal 35, and the above-mentioned energizing route is disconnected.

[0036]When the pressure within the cell case 14 continues rising in spite of cutting of this energizing route, As shown in drawing 12, the synthetic resin film 3 and the aluminum foil 4 of the plate spring 1 are torn, the gas within the cell case 14 is emitted outside via the hole 37a of the electrode lid 37 from the hole 2a of the center of the main part 2 of a plate spring, and explosion of the cell case 14 is prevented.

[0037]Therefore, explosion of this rechargeable battery 11 is prevented also here by operation of Mie called control of an over-current, cutting of an energizing route, and discharge of inner gas.

[0038]By the way, in this safeguard 31, operation can be inspected in the following procedures, without destroying this safeguard 31.

[0039]First, it is inspected whether between the electrode lid 37 of the safeguard 31 and the terminal 42 has flowed. They are inferior goods if it has not flowed.

[0040]Next, in addition to the plate spring 1, this plate spring 1 is reversed for a pressure through the hole 32a of the conductor case 32. They are inferior goods if between the electrode lid 37 and the terminal 42 has still flowed at this time.

[0041]A thin stick (not shown) is inserted in the hole 37a of the electrode lid 37, this thin stick pokes and takes down the head 41a of the spring aggressiveness 41 of the contact piece 38, it is made again reversed and the plate spring 1 is returned to the original state. Thereby, if between the electrode lid 37 and the terminal 42 flows again, this safeguard 31 will be judged to be an excellent article.

[0042]Drawing 13 shows a 2nd embodiment of the plate spring of this invention. This plate spring 51 is in agreement at the point which plugs up the hole 52a of the center of the main part 52 of a plate spring with the synthetic resin film 53 and the aluminum foil 54 as compared with the plate spring 1 of drawing 1 and drawing 2, and differs in that this main part 52 of a plate spring is a thing made from bimetal.

[0043]The main part 52 of a plate spring made from this bimetal has the section structure which consists of the two layers 52b and 52c. These layers 52b and 52c are layers of each metal which has each coefficient of thermal expansion which is mutually different, and their coefficient of thermal expansion is smaller than the layer 52c of the side in which the direction of the layer 52b of the side in which the main part 52 of a plate spring swelled became depressed. For this reason, if

the temperature of this main part 52 of a plate spring reaches the level defined beforehand, this main part 52 of a plate spring will be reversed [ the direction of the layer 52c of the side hollow rather than the layer 52b of the swollen side develops, and both difference becomes large, and ], so that the temperature of the main part 52 of a plate spring rises.

[0044] Since there is a thing of not only two-layer but three layers in bimetal, this may be applied.

[0045] This plate spring 51 is applicable instead of the plate spring 1 in the safeguard 31 shown in the safeguard 12 shown in drawing 5, and drawing 8. In this case, not only when it is in overcharge or a short condition and the pressure within the cell case 14 rises, but when the temperature of this plate spring 51 rises by generation of heat of the power generation element 13, this plate spring 51 is reversed, the energizing route of the rechargeable battery 11 is disconnected, and current is intercepted.

[0046] Therefore, in the rechargeable battery 11 which applied this plate spring 51, Explosion protection of this rechargeable battery 11 is performed by discharge of the inner gas by destruction of cutting of the energizing route by reversal of the plate spring 51 which answers control, pressure buildup, or rise in heat of an over-current with a PCT board, the synthetic resin film 53, and the aluminum foil 54.

[0047] In order to plug up the hole, what pasted the metallic foil and the synthetic resin film together is used for the plate spring of each above-mentioned embodiment, but it is not limited to this but may apply the thing of other construction material torn with a proper pressure. For example, application of the thin film film made of a synthetic resin can be considered.

[0048]

[Effect] As explained above, the plate spring for the safeguards of this invention, Since two kinds of duties called the change of the switch which has a hole, comes for a sheet to close this hole, and was applied to the safeguard of the rechargeable battery, for example, was inserted in the energizing route, and discharge of gas are achieved, simplification of the structure of this safeguard is enabled.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

TECHNICAL FIELD

---

[Field of the Invention]This invention relates to the suitable plate spring for safeguards for the safeguard for preventing explosion of a rechargeable battery, for example.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art]In recent years, a demand called an improvement of the heavy loading characteristic of the rechargeable battery used as a power supply and the densification of energy is becoming strong with the spread of a video camera, a headphone stereo cassette tape recorder, portable telephones, etc. Although the nickel KADONIUMU cell used conventionally can be mentioned as a rechargeable battery which fills this demand, these days, a lithium cell attracts attention and development and use of this lithium cell are activating.

[0003]Generally this kind of rechargeable battery is sealed type structure. For this reason, if a power generation element generates heat and gas is emitted from this power generation element by overcharge, a short circuit, etc., the pressure within a cell case will rise and degradation of battery capacity will be caused. It may result in explosion of a cell case, and surrounding apparatus is damaged or harm is inflicted on the surrounding person.

[0004]In order to prevent such an accident, the safeguard is formed in this kind of rechargeable battery. For example, there are what inserted in the energizing route of this cell the PTC board (it has the characteristic that resistance increases rapidly when the temperature defined beforehand is exceeded), a thing which inserted in the energizing route the switch which switches with the pressure in this cell, etc. Or there are some which compounded these and improved safety and this compounded thing is more common.

---

[Translation done.]



**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**EFFECT OF THE INVENTION**

---

[Effect]As explained above, the plate spring for the safeguards of this invention, Since two kinds of duties called the change of the switch which has a hole, comes for a sheet to close this hole, and was applied to the safeguard of the rechargeable battery, for example, was inserted in the energizing route, and discharge of gas are achieved, simplification of the structure of this safeguard is enabled.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**TECHNICAL PROBLEM**

---

[Problem(s) to be Solved by the Invention]However, although safety increased when several kinds of safeguards were compounded, there was a problem referred to as causing complication of structure and the jump of cost.

[0006]Then, there is a technical problem of this invention in providing the plate spring for safeguards which enables composite of two kinds of safeguards, without being accompanied by complication of structure.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem]In order to solve an aforementioned problem, a plate spring for safeguards of this invention has a hole, and plugs up this hole with a sheet.

[0008]For example, when applying this plate spring to a safeguard of a rechargeable battery, it arranges so that this plate spring may be reversed in response to a pressure in this cell, and a normally closed switch which carries out Kaisei by reversal of this plate spring is inserted in an energizing route of this cell. A gas path from which gas in this cell escapes through a hole of this plate spring is formed. In such a structure, since a plate spring will be reversed and a switch will carry out Kaisei in connection with this if gas is emitted from a power generation element of a cell and a pressure in this cell rises by overcharge, a short circuit, etc., an energizing route of this cell is disconnected and current is intercepted. And if a pressure in a cell continues rising in spite of interception of this current, a sheet of a hole of a plate spring will be torn and gas in a cell will be discharged outside through a gas path. Thereby, a pressure in a cell declines and cell bursting is prevented.

[0009]That is, since a plate spring of this invention achieves two kinds of duties called a change of a switch, and discharge of gas, it can simplify structure of this safeguard.

[0010]As a sheet which plugs up a hole of a plate spring, there is a metallic foil, for example. When this metallic foil closes a hole of a plate spring, in order to prevent an electric corrosion generated between a metallic foil and a plate spring, it is preferred to make a synthetic resin layer intervene among both.

[0011]A thing of bimetal may be applied as a plate spring. Also when applying a plate spring of this bimetal to a rechargeable battery, a normally closed switch which carries out Kaisei by reversal of this plate spring is inserted in an energizing route of this cell, and a gas path from which gas in this cell escapes through a hole of this plate spring is formed. In such a structure, if a power generation element of this cell generates heat by overcharge, a short circuit, etc., a plate spring will be reversed, a switch of an energizing route will carry out Kaisei, and current will be intercepted by this heat. And if a power generation element of a cell continues generating heat and a pressure in a cell continues rising in connection with this in spite of interception of this current, a sheet of a hole of a plate spring will be torn, gas in a cell will be discharged outside, and cell bursting will be prevented.

[0012]

[Embodiment of the Invention]Hereafter, this embodiment of the invention is described with reference to an accompanying drawing.

[0013]Drawing 1 and drawing 2 show a 1st embodiment of the plate spring of this invention. This plate spring 1 laminates the main part 2 of a plate spring, the synthetic resin film 3, and the aluminum foil 4 made from stainless steel one by one, and plugs up the hole 2a of the center of this main part 2 of a plate spring with the synthetic resin film 3 and the aluminum foil 4.

[0014]The synthetic resin film 3 intervenes between the main part 2 of a plate spring, and the aluminum foil 4, and achieves the duty which prevents the electric corrosion produced between

dissimilar metals.

[0015]Although laminating is only available for the synthetic resin film 3 and the aluminum foil 4, when it may paste up and pastes them up, they use welding by the solvent of the synthetic resin film 3, or heating, or adhesives are used for them. As shown in drawing 3, each synthetic resin films 5 and 6 may be laminated to both sides of the aluminum foil 4, and this aluminum foil 4 may be covered.

[0016]Or aluminum foil may be formed in one field of a synthetic resin film by metal deposition. After vapor-depositing aluminum foil to one field of a synthetic resin film, other synthetic resin films may be laminated and aluminum foil may be inserted between the synthetic resin films of two sheets.

[0017]Synthetic coating material and adhesives may be applied to one side of aluminum foil, the field of these synthetic coating material and adhesives may be laid on top of the main part 2 of a plate spring, and aluminum foil and the main part of a plate spring may be pasted up. Synthetic coating material and adhesives may be applied to both sides of aluminum foil.

[0018]Of course, the thing of the metal of other kinds may be applied as construction material of a plate spring or a metallic foil.

[0019]Under environment which the construction material of the main part 2 of a plate spring and the construction material of the metallic foil which plugs up the hole 2a of this main part 2 of a plate spring are not the same, or an electric corrosion does not generate, when using this plate spring 1, a synthetic resin film may be omitted and direct lamination of the main part 2 of a plate spring and the metallic foil may be carried out. Aluminum foil is omitted and only a synthetic resin film is not cared about.

[0020]Now, such a plate spring 1 is applied to the safeguard 12 of the rechargeable battery 11 as shown in drawing 4. In this rechargeable battery 11, the power generation element 13 is closed to the cell case 14, and the safeguard 12 is supported by caulking processing which made the insulator 15 placed between the upper beds of this cell case 14.

[0021]This safeguard 12 piles up the gasket 18, the plate spring 1, the spacer 19, the PTC board 21, the annular terminal 22, and the insulating seal 23 one by one inside the conductor case 17, as shown in drawing 5. After inserting the moving piece 24 in the hole of the PTC board 21 and the annular terminal 22, the electrode lid 26 which welded the contact piece 25 by resistance on this is put, the periphery of the conductor case 17 is crimped and processed, the insulating seal 23 is made to intervene and the periphery of this electrode lid 26 is put.

[0022]If the temperature defined beforehand is exceeded, the PTC board 21 is a positive thermistor with the characteristic that resistance increases rapidly, and although it is low resistance at ordinary temperature, it is formed for improvement in safety so that it may state later.

[0023]The hole 17a is formed in the bottom of the conductor case 17. The plate spring 1 has faced the inside of the rechargeable battery 11 via the hole 17a of this conductor case 17. The terminal 29 is hung down and moved back to the periphery of this hole 17a, and this terminal 29 is connected to the power generation element 13 through the lead 30.

[0024]The contact piece 25 of the electrode lid 26 has sufficient elasticity, and the tip touches the annular terminal 22.

[0025]the energizing route of this safeguard 12 -- terminal 29-> of the power generation element 13 -> lead 30 -> conductor case 17 -- it is called the spacer 19 ->PTC board 21 -> annular terminal 22 -> contact piece 25 -> electrode lid 26.

[0026]In such composition, if it will be in overcharge or a short condition and an over-current flows, the PTC board 21 of the above-mentioned energizing route will generate heat, and resistance of this PTC board 21 will become very large. By this, an over-current is controlled, current becomes small, and overcharge or a short condition is avoided.

[0027]If gas is emitted from the power generation element 13, the pressure within the cell case 14 rises and a permissible level is exceeded in spite of control of an over-current with this PTC board 21, as shown in drawing 6, the plate spring 1 is reversed, the rear face of this plate spring 1 will

swell, and the moving piece 24 will be pushed up by this pressure. In connection with this, the tip of the contact piece 25 is also pushed up and this tip estranges from the annular terminal 22. As a result, the above-mentioned energizing route is disconnected and current is intercepted.

[0028]In this way, in spite of having intercepted current, when gas continues being emitted from the power generation element 13 and the pressure within the cell case 14 continues rising, As shown in drawing 7, the synthetic resin film 3 and the aluminum foil 4 of the plate spring 1 are torn, and the gas within the cell case 14 results inside the electrode lid 26 from the hole 2a of the center of the main part 2 of a plate spring, and is emitted outside from the hole 26a of this electrode lid 26.

Thereby, explosion of the cell case 14 is prevented.

[0029]That is, in this rechargeable battery 11, the operation of Mie called discharge of the inner gas by destruction of control of an over-current with the PCT board 21, cutting of the energizing route by reversal of the plate spring 1, the synthetic resin film 3, and the aluminum foil 4 is performing explosion protection of this rechargeable battery 11.

[0030]Two things in an operation here of this Mie, i.e., the operation called cutting of an energizing route, and the operation called discharge of inner gas originate in operation of the one plate spring 1. If it puts in another way, this plate spring 1 has achieved two duties simultaneously. This enables simplification of the structure of this safeguard 12.

[0031]Drawing 8 shows other examples of the safeguard which applied the plate spring 1 shown in drawing 1 and drawing 2. This safeguard 31 piles up the gasket 33, the plate spring 1, the PTC board 34, the annular terminal 35, and the insulating seal 36 one by one inside the conductor case 32, and puts the periphery of the contact piece 38 between the insulating seal 36 and the electrode lid 37, This electrode lid 37 is put, the periphery of the conductor case 32 is crimped and processed, the insulator 39 is made to intervene and the periphery of this electrode lid 37 is put.

[0032]The contact piece 38 of the electrode lid 37 has the annular piece 38a and the ligula 38b, as shown in drawing 9, it sandwiches the annular piece 38a between the insulating seal 36 and the electrode lid 37, and is contacting the ligula 38b for the annular terminal 35. A hole is formed in the ligula 38b of this contact piece 38, and the spring aggressiveness 41 is pressed fit in this hole. This spring aggressiveness 41 has the head 41a and the two legs 41b, as shown in drawing 10, and it makes the gap of these legs 41b larger than the diameter of the hole 2a of the main part 2 of a plate spring.

[0033]This safeguard 31 is also applied to the rechargeable battery 11 shown in drawing 4, and that energizing route says it as the terminal 42 → PTC board 34 → annular terminal 35 → contact piece 38 → electrode lid 37 of the power generation element 13 → lead 30 → conductor case 32.

[0034]Here, if it will be in overcharge or a short condition and an over-current flows, the PTC board 34 of the above-mentioned energizing route will generate heat, the resistance will become very large, and overcharge or a short condition will be avoided.

[0035]If the pressure within the cell case 14 rises and a permissible level is exceeded in spite of control of this current, as shown in drawing 11, the plate spring 1 will be reversed, and this plate spring 1 will thrust up each leg 41b of the spring aggressiveness 41. In connection with this, the tip of the contact piece 38 estranges from the annular terminal 35, and the above-mentioned energizing route is disconnected.

[0036]When the pressure within the cell case 14 continues rising in spite of cutting of this energizing route, As shown in drawing 12, the synthetic resin film 3 and the aluminum foil 4 of the plate spring 1 are torn, the gas within the cell case 14 is emitted outside via the hole 37a of the electrode lid 37 from the hole 2a of the center of the main part 2 of a plate spring, and explosion of the cell case 14 is prevented.

[0037]Therefore, explosion of this rechargeable battery 11 is prevented also here by operation of Mie called control of an over-current, cutting of an energizing route, and discharge of inner gas.

[0038]By the way, in this safeguard 31, operation can be inspected in the following procedures, without destroying this safeguard 31.

[0039]First, it is inspected whether between the electrode lid 37 of the safeguard 31 and the terminal 42 has flowed. They are inferior goods if it has not flowed.

[0040]Next, in addition to the plate spring 1, this plate spring 1 is reversed for a pressure through the hole 32a of the conductor case 32. They are inferior goods if between the electrode lid 37 and the terminal 42 has still flowed at this time.

[0041]A thin stick (not shown) is inserted in the hole 37a of the electrode lid 37, this thin stick pokes and takes down the head 41a of the spring aggressiveness 41 of the contact piece 38, it is made again reversed and the plate spring 1 is returned to the original state. Thereby, if between the electrode lid 37 and the terminal 42 flows again, this safeguard 31 will be judged to be an excellent article.

[0042]Drawing 13 shows a 2nd embodiment of the plate spring of this invention. This plate spring 51 is in agreement at the point which plugs up the hole 52a of the center of the main part 52 of a plate spring with the synthetic resin film 53 and the aluminum foil 54 as compared with the plate spring 1 of drawing 1 and drawing 2, and differs in that this main part 52 of a plate spring is a thing made from bimetal.

[0043]The main part 52 of a plate spring made from this bimetal has the section structure which consists of the two layers 52b and 52c. These layers 52b and 52c are layers of each metal which has each coefficient of thermal expansion which is mutually different, and their coefficient of thermal expansion is smaller than the layer 52c of the side in which the direction of the layer 52b of the side in which the main part 52 of a plate spring swelled became depressed. For this reason, if the temperature of this main part 52 of a plate spring reaches the level defined beforehand, this main part 52 of a plate spring will be reversed [ the direction of the layer 52c of the side hollow rather than the layer 52b of the swollen side develops, and both difference becomes large, and ], so that the temperature of the main part 52 of a plate spring rises.

[0044]Since there is a thing of not only two-layer but three layers in bimetal, this may be applied.

[0045]This plate spring 51 is applicable instead of the plate spring 1 in the safeguard 31 shown in the safeguard 12 shown in drawing 5, and drawing 8. In this case, not only when it is in overcharge or a short condition and the pressure within the cell case 14 rises, but when the temperature of this plate spring 51 rises by generation of heat of the power generation element 13, this plate spring 51 is reversed, the energizing route of the rechargeable battery 11 is disconnected, and current is intercepted.

[0046]Therefore, in the rechargeable battery 11 which applied this plate spring 51, Explosion protection of this rechargeable battery 11 is performed by discharge of the inner gas by destruction of cutting of the energizing route by reversal of the plate spring 51 which answers control, pressure buildup, or rise in heat of an over-current with a PCT board, the synthetic resin film 53, and the aluminum foil 54.

[0047]In order to plug up the hole, what pasted the metallic foil and the synthetic resin film together is used for the plate spring of each above-mentioned embodiment, but it is not limited to this but may apply the thing of other construction material torn with a proper pressure. For example, application of the thin film film made of a synthetic resin can be considered.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

## DESCRIPTION OF DRAWINGS

---

### [Brief Description of the Drawings]

[Drawing 1]The perspective view showing a 1st embodiment of the plate spring of this invention

[Drawing 2]The sectional view showing the plate spring of drawing 1

[Drawing 3]The sectional view in which expanding the modification of the plate spring of drawing 1 selectively, and showing it

[Drawing 4]The sectional view showing a rechargeable battery provided with the safeguard with which the plate spring of drawing 1 is applied

[Drawing 5]The sectional view showing the safeguard of drawing 4

[Drawing 6]The figure used in order to explain an operation of the safeguard of drawing 4

[Drawing 7]The figure used in order to explain other operations of the safeguard of drawing 4

[Drawing 8]The sectional view showing other safeguards with which the plate spring of drawing 1 is applied

[Drawing 9]The perspective view showing the contact piece in the safeguard of drawing 8

[Drawing 10]The perspective view showing the spring aggressiveness in the safeguard of drawing 8

[Drawing 11]The figure used in order to explain an operation of the safeguard of drawing 8

[Drawing 12]The figure used in order to explain other operations of the safeguard of drawing 8

[Drawing 13]The sectional view showing a 2nd embodiment of the plate spring of this invention

### [Description of Notations]

- 1, 51 plate springs
- 2, the main part of 52 plate springs
- 3, 53 synthetic resin films
- 4, 54 aluminum foil
- 11 Rechargeable battery
- 12 and 31 Safeguard
- 13 Power generation element
- 14 Cell case
- 15 and 39 Insulator
- 17, 32 conductor cases
- 18 and 33 Gasket
- 19 Spacer
- 21, 34 PTC board
- 22 and 35 Annular terminal
- 23, 36 insulating seals
- 24 Moving piece
- 25 and 38 Contact piece
- 26 and 37 Electrode lid
- 29 and 42 Terminal

30 Lead

41 Spring aggressiveness

---

[Translation done.]



\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

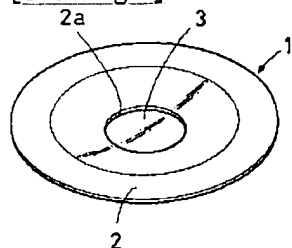
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

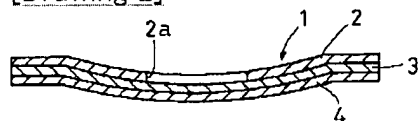
**DRAWINGS**

---

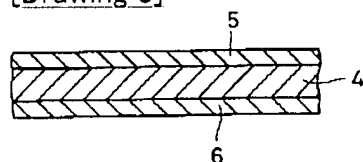
[Drawing 1]



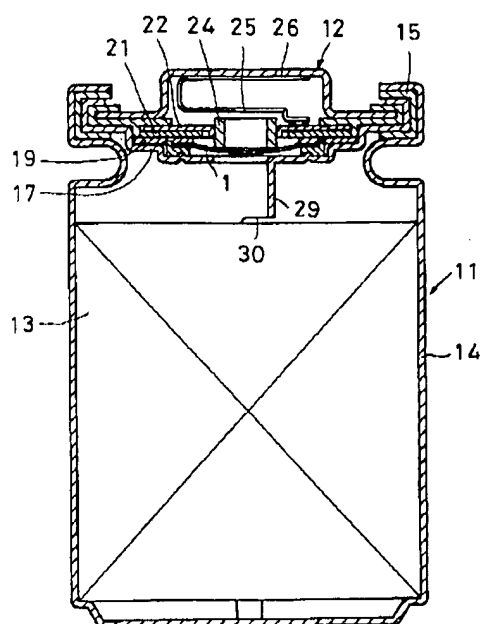
[Drawing 2]



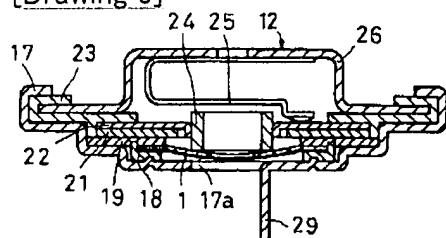
[Drawing 3]



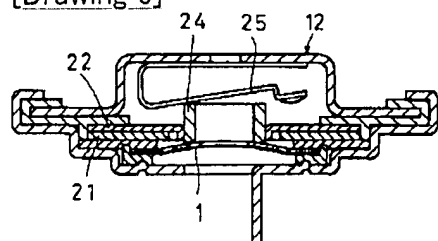
[Drawing 4]



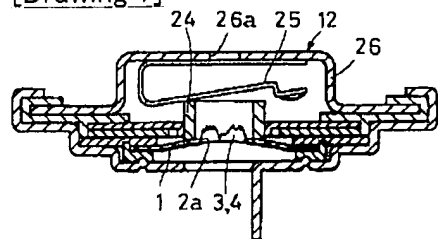
[Drawing 5]



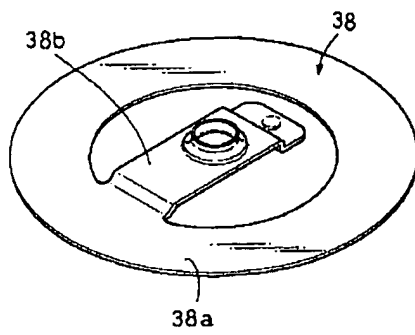
[Drawing 6]



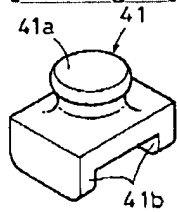
[Drawing 7]



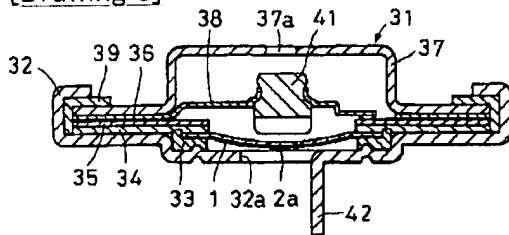
[Drawing 9]



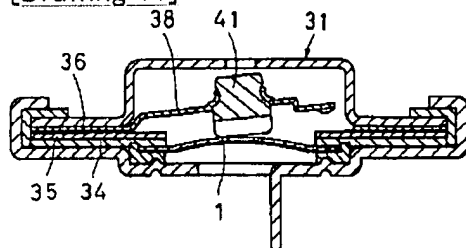
[Drawing 10]



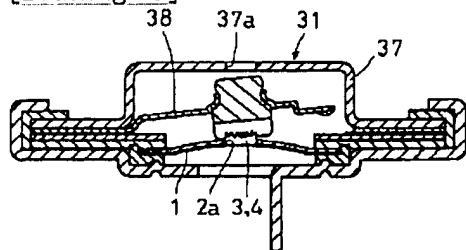
[Drawing 8]



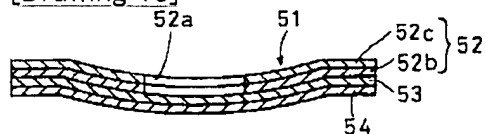
[Drawing 11]



[Drawing 12]



[Drawing 13]



---

[Translation done.]

F-8310

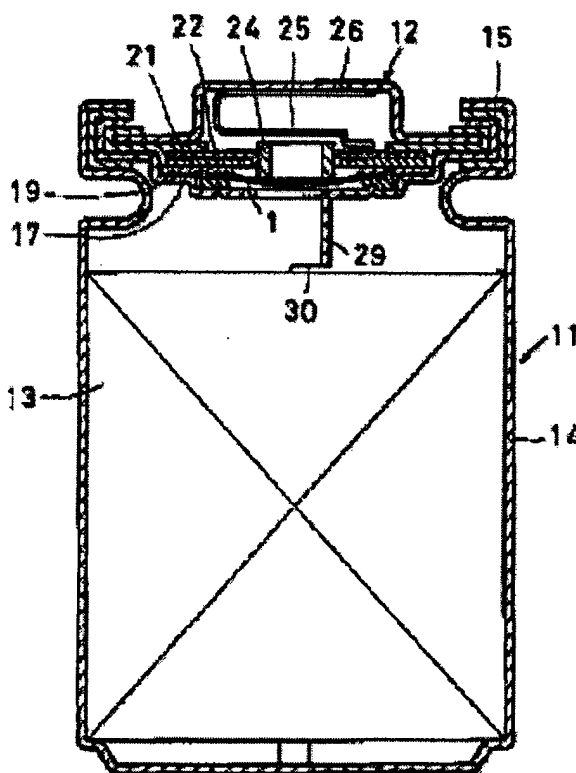
**CONED DISC SPRING FOR SAFETY DEVICE**

**Publication number:** JP9134714  
**Publication date:** 1997-05-20  
**Inventor:** IMOTO AKIRA; KAMEISHI TOSHIZO  
**Applicant:** WAKO DENSHI KK  
**Classification:**  
- **International:** **H01M2/12; H01M2/12;** (IPC1-7): H01M2/12  
- **European:**  
**Application number:** JP19950288845 19951107  
**Priority number(s):** JP19950288845 19951107

Report a data error here

**Abstract of JP9134714**

**PROBLEM TO BE SOLVED:** To provide a spring for safety device, with which two types of safety devices can be used complexly without causing complication of the structure.  
**SOLUTION:** The current feeding path for a safety device 12 follows a route consisting of a power generating element 13, lead 30, terminal 29 of conductor case 17, spacer 19, PTC plate 21, ring-shaped terminal 22, contact piece 25, and electrode lid 26. When an over-current flows, the PTC plate 21 emits heat and its resistance becomes very large so that the over-current is suppressed. If nevertheless gas is generated from the element 13 and the internal pressure of a battery case 14 rises, a coned disc spring 1 is inverted so that the tip of the contact piece 25 is heaved to cause separation from the terminal 22, and the current feeding path is shut. If the internal pressure of the case 14 continues still rising, a plastic film and aluminum foil at a hole in the disc spring 1 are broken, and the gas is released to the outside.



Data supplied from the esp@cenet database - Worldwide

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平9-134714

(43) 公開日 平成9年(1997)5月20日

(51) Int.Cl. <sup>6</sup>	識別記号	庁内整理番号	F I	技術表示箇所
H 0 1 M 2/12	1 0 1		H 0 1 M 2/12	1 0 1

審査請求 未請求 請求項の数4 O L (全 6 頁)

(21) 出願番号 特願平7-288845

(22) 出願日 平成7年(1995)11月7日

(71) 出願人 390003768

ワコー電子株式会社

大阪府大阪市天王寺区悲田院町8番22号

(72) 発明者 井元 章

御所市玉手380番地 ワコー電子株式会社

御所事業所内

(72) 発明者 亀石 敏造

御所市玉手380番地 ワコー電子株式会社

御所事業所内

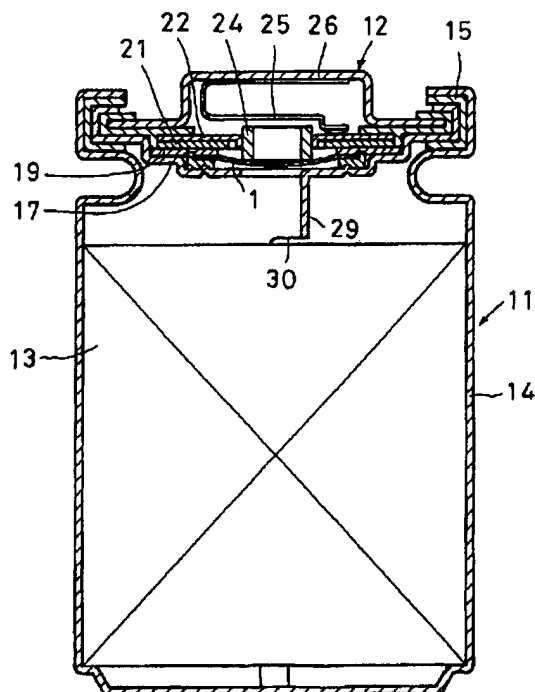
(74) 代理人 弁理士 鎌田 文二 (外2名)

(54) 【発明の名称】 安全装置用の皿バネ

(57) 【要約】

【課題】 構造の複雑化を伴わずに、2種類の安全装置の複合を可能にする安全装置用の皿バネを提供する。

【解決手段】 安全装置12の通電経路は、発電要素13→リード線30→導体ケース17の端子29→スペーサ19→PTC板21→環状端子22→接片25→電極蓋26と言うものである。このような構成において、過電流が流れると、PTC板21が発熱して、その抵抗が極めて大きくなり、過電流が抑制される。これにもかかわらず、発電要素13からガスが発生し、電池ケース14内の圧力が上昇すると、この圧力によって、皿バネ1が反転して、接片25の先端が押し上げられて、環状端子22から離間し、通電経路が切断される。更に、電池ケース14内の圧力が上昇し続けた場合は、皿バネ1の孔の合成樹脂フィルム及びアルミ箔が破れ、ガスが外部に放出される。



**【特許請求の範囲】**

【請求項1】 孔を有し、この孔をシートによって塞いだ安全装置用の皿バネ。

【請求項2】 シートは、金属箔である請求項1に記載の安全装置用の皿バネ。

【請求項3】 金属箔のシートと皿バネの間に、合成樹脂層を介在させた請求項2に記載の安全装置用の皿バネ。

【請求項4】 異なるそれぞれの熱膨張率を有する各金属層を積層したバイメタルからなる請求項1に記載の安全装置用の皿バネ。

**【発明の詳細な説明】****【0001】**

【発明の属する技術分野】この発明は、例えば二次電池の爆発を防止するための安全装置に好適な安全装置用の皿バネに関する。

**【0002】**

【従来の技術】近年、ビデオカメラ、ヘッドホンステレオ、携帯電話機等の普及に伴い、電源となる二次電池の重負荷特性の改善や、エネルギーの高密度化という要求が強まって来ている。この要求を充たす二次電池として、従来より利用されているニッケルカドニウム電池を挙げることができるが、最近ではリチウム電池が目ざされ、このリチウム電池の開発及び利用が活発化している。

【0003】この種の二次電池は、一般に密封形構造である。このため、過充電、短絡等によって、発電要素が発熱し、この発電要素からガスが発生すると、電池ケース内の圧力が上昇し、電池性能の劣化を招く。さらには、電池ケースの爆発に至ることがあり、周囲の機器を損傷させたり、周囲の人に危害を与える。

【0004】このような事故を防止するために、この種の二次電池には、安全装置を設けている。例えば、PTC板（予め定められた温度を越えると、抵抗が急激に増大する特性を有する）を該電池の通電経路に挿入したものや、この電池内の圧力によって切り換わるスイッチを通電経路に挿入したもの等がある。あるいは、これらを複合して安全性を高めたものがあり、この複合したものの方がより一般的ではある。

**【0005】**

【発明が解決しようとする課題】しかしながら、幾種類かの安全装置を複合すると、安全性が高まるものの、構造の複雑化やコストの高騰を招くと言う問題があった。

【0006】そこで、この発明の課題は、構造の複雑化を伴わずに、2種類の安全装置の複合を可能にする安全装置用の皿バネを提供することにある。

**【0007】**

【課題を解決するための手段】上記課題を解決するために、この発明の安全装置用の皿バネは、孔を有し、この孔をシートによって塞いでなる。

【0008】例えば、この皿バネを二次電池の安全装置に適用する場合、この皿バネを該電池内の圧力を受けて反転するように配置し、この皿バネの反転によって開成する常閉スイッチを該電池の通電経路に挿入しておく。また、この皿バネの孔を通じて該電池内のガスが抜けるガス経路を形成しておく。このような構造においては、過充電、短絡等によって、電池の発電要素からガスが発生し、この電池内の圧力が上昇すると、皿バネが反転し、これに伴ってスイッチが開成するので、この電池の通電経路が切断され、電流が遮断される。そして、この電流の遮断にもかかわらず、電池内の圧力が上昇し続けると、皿バネの孔のシートが破け、電池内のガスがガス経路を通じて外部に排出される。これにより、電池内の圧力が低下し、電池の爆発が防止される。

【0009】すなわち、この発明の皿バネは、スイッチの切換えと、ガスの排出という2種類の役目を果たすので、この安全装置の構造を簡単化することができる。

【0010】皿バネの孔を塞ぐシートとしては、例えば金属箔がある。この金属箔によって皿バネの孔を塞ぐ場合、金属箔と皿バネ間で発生する電蝕を防止するために、両者の間に合成樹脂層を介在させるのが好ましい。

【0011】また、皿バネとして、バイメタルのものを適用しても構わない。このバイメタルの皿バネを二次電池に適用する場合も、この皿バネの反転によって開成する常閉スイッチを該電池の通電経路に挿入し、この皿バネの孔を通じて該電池内のガスが抜けるガス経路を形成しておく。このような構造においては、過充電、短絡等によって、この電池の発電要素が発熱すると、この熱によって、皿バネが反転し、通電経路のスイッチが開成して、電流が遮断される。そして、この電流の遮断にもかかわらず、電池の発電要素が発熱し続け、これに伴い、電池内の圧力が上昇し続けると、皿バネの孔のシートが破けて、電池内のガスが外部に排出され、電池の爆発が防止される。

**【0012】**

【発明の実施の形態】以下、この発明の実施の形態を添付図面を参照して説明する。

【0013】図1及び図2は、この発明の皿バネの第1実施形態を示している。この皿バネ1は、ステンレス製の皿バネ本体2、合成樹脂フィルム3及びアルミ箔4を順次積層して、この皿バネ本体2の中央の孔2aを合成樹脂フィルム3及びアルミ箔4によって塞いでなる。

【0014】合成樹脂フィルム3は、皿バネ本体2とアルミ箔4間に介在し、異種金属間に生じる電蝕を防止する役目を果たす。

【0015】合成樹脂フィルム3とアルミ箔4は、単に積層するだけでも構わないが、接着しても良く、それらを接着する場合は、合成樹脂フィルム3の溶剤あるいは加熱による溶着を利用したり、接着剤を使用する。また、図3に示すようにアルミ箔4の両面に各合成樹脂フ

フィルム5、6を積層して、このアルミ箔4を被っても構わない。

【0016】あるいは、金属蒸着によって、合成樹脂フィルムの一方の面にアルミ箔を形成しても良い。また、合成樹脂フィルムの一方の面にアルミ箔を蒸着してから、他の合成樹脂フィルムを積層して、2枚の合成樹脂フィルムの間にアルミ箔を挟んでも構わない。

【0017】さらに、アルミ箔の片面に合成樹脂塗料や接着剤を塗布し、この合成樹脂塗料や接着剤の面を皿バネ本体2に重ね合わせて、アルミ箔と皿バネ本体を接着しても良い。また、アルミ箔の両面に合成樹脂塗料や接着剤を塗布しても構わない。

【0018】勿論、皿バネや金属箔の材質として、他の種類の金属のものを適用しても良い。

【0019】なお、皿バネ本体2の材質と、この皿バネ本体2の孔2aを塞ぐ金属箔の材質が同一であったり、電蝕が発生しないような環境下で、この皿バネ1を使用する場合は、合成樹脂フィルムを省略して、皿バネ本体2と金属箔を直接積層しても構わない。また、アルミ箔を省略し、合成樹脂フィルムのみでも構わない。

【0020】さて、このような皿バネ1は、図4に示すような二次電池11の安全装置12に適用される。この二次電池11では、発電要素13を電池ケース14に封止しており、この電池ケース14の上端に、絶縁体15を介在させたカシメ加工によって、安全装置12を支持している。

【0021】この安全装置12は、図5に示すように導体ケース17の内側に、ガスケット18、皿バネ1、スペーサ19、PTC板21、環状端子22、及び絶縁シール23を順次重ね合わせ、PTC板21及び環状端子22の孔に移動片24を挿入してから、この上に接片25を抵抗溶接した電極蓋26を被せ、導体ケース17の周縁をカシメ加工して、この電極蓋26の周縁を絶縁シール23を介在させて挟み込んでなる。

【0022】PTC板21は、常温では低い抵抗であるが、予め定められた温度を越えると、抵抗が急激に増大するという特性を持つ正特性サーミスタであり、後で述べるように安全性の向上のために設けられている。

【0023】導体ケース17の底には、孔17aを形成している。皿バネ1は、この導体ケース17の孔17aを介して二次電池11の内側を臨んでいる。また、この孔17aの周縁には、端子29を垂れ下げており、この端子29をリード線30を通じて発電要素13に接続している。

【0024】電極蓋26の接片25は、十分な弾性を有しており、その先端が環状端子22に接触している。

【0025】この安全装置12の通電経路は、発電要素13→リード線30→導体ケース17の端子29→スペーサ19→PTC板21→環状端子22→接片25→電極蓋26と言うものである。

【0026】このような構成において、過充電又は短絡状態となり、過電流が流れると、上記通電経路のPTC板21が発熱して、このPTC板21の抵抗が極めて大きくなる。これにより、過電流が抑制されて、電流が小さくなり、過充電又は短絡状態が回避される。

【0027】このPTC板21による過電流の抑制にもかかわらず、発電要素13からガスが発生し、電池ケース14内の圧力が上昇して許容レベルを越えると、この圧力によって、図6に示すように皿バネ1が反転して、この皿バネ1の裏面が脹らみ、移動片24が押し上げられる。これに伴って、接片25の先端も押し上げられ、この先端が環状端子22から離間する。この結果、上記通電経路が切断されて、電流が遮断される。

【0028】こうして電流を遮断したにもかかわらず、発電要素13からガスが発生し続け、電池ケース14内の圧力が上昇し続けた場合は、図7に示すように皿バネ1の合成樹脂フィルム3及びアルミ箔4が破れ、電池ケース14内のガスは、皿バネ本体2の中央の孔2aから電極蓋26の内側に至り、この電極蓋26の孔26aから外部に放出される。これにより、電池ケース14の爆発が防止される。

【0029】すなわち、この二次電池11においては、PTC板21による過電流の抑制、皿バネ1の反転による通電経路の切断、及び合成樹脂フィルム3及びアルミ箔4の破壊による内部ガスの放出と言う三重の作用によって、この二次電池11の防爆を行っている。

【0030】ここで、この三重の作用のうちの2つのもの、つまり通電経路の切断と言う作用、及び内部ガスの放出と言う作用は、1つの皿バネ1の動作に起因するものである。換言すれば、この皿バネ1は、同時に2つの役目を果たしている。このことが、この安全装置12の構造の簡単化を可能にする。

【0031】図8は、図1及び図2に示す皿バネ1を適用した安全装置の他の例を示している。この安全装置31は、導体ケース32の内側に、ガスケット33、皿バネ1、PTC板34、環状端子35、及び絶縁シール36を順次重ね合わせ、絶縁シール36と電極蓋37の間に接片38の周縁を挟み込んで、この電極蓋37を被せ、導体ケース32の周縁をカシメ加工して、この電極蓋37の周縁を絶縁体39を介在させて挟み込んでなる。

【0032】電極蓋37の接片38は、図9に示すように環状片38a、及び舌状片38bを有しており、環状片38aを絶縁シール36と電極蓋37の間に挟み、舌状片38bを環状端子35に接触させている。また、この接片38の舌状片38bに孔を形成し、この孔にバネ押し41を圧入している。このバネ押し41は、図10に示すように頭部41a、及び2つの脚部41bを有しており、これらの脚部41bの間隙を皿バネ本体2の孔2aの直径よりも広くしている。



【0033】この安全装置31も図4に示す二次電池11に適用され、その通電経路は、発電要素13→リード線30→導体ケース32の端子42→PTC板34→環状端子35→接片38→電極蓋37と言うものである。

【0034】ここで、過充電又は短絡状態となり、過電流が流れると、上記通電経路のPTC板34が発熱して、その抵抗が極めて大きくなり、過充電又は短絡状態が回避される。

【0035】この電流の抑制にもかかわらず、電池ケース14内の圧力が上昇して許容レベルを越え、図11に示すように皿バネ1が反転し、この皿バネ1がバネ押し41の各脚部41bを突き上げる。これに伴って、接片38の先端が環状端子35から離間し、上記通電経路が切断される。

【0036】この通電経路の切断にもかかわらず、電池ケース14内の圧力が上昇し続けた場合は、図12に示すように皿バネ1の合成樹脂フィルム3及びアルミ箔4が破れ、電池ケース14内のガスが皿バネ本体2の中央の孔2aから電極蓋37の孔37aを介して外部に放出され、電池ケース14の爆発が防止される。

【0037】したがって、ここでも、過電流の抑制、通電経路の切断、及び内部ガスの放出と言う三重の作用によって、この二次電池11の爆発を防止している。

【0038】ところで、この安全装置31では、この安全装置31を破壊することなく、次の様な手順で動作の検査を行うことができる。

【0039】まず、安全装置31の電極蓋37と端子42間が導通しているか否かを検査する。導通していなければ、不良品である。

【0040】次に、圧力を導体ケース32の孔32aを通じて皿バネ1に加え、この皿バネ1を反転させる。このときに、電極蓋37と端子42間が未だに導通していれば、不良品である。

【0041】更に、細い棒（図示せず）を電極蓋37の孔37aに差し込んで、この細い棒によって、接片38のバネ押し41の頭部41aを突き下ろし、皿バネ1を再び反転させて元の状態に戻す。これにより、電極蓋37と端子42間が再び導通すれば、この安全装置31を良品と判断する。

【0042】図13は、この発明の皿バネの第2実施形態を示している。この皿バネ51は、図1及び図2の皿バネ1と比較すると、皿バネ本体52の中央の孔52aを合成樹脂フィルム53及びアルミ箔54によって塞ぐ点で一致し、この皿バネ本体52がバイメタル製のものである点で異なる。

【0043】このバイメタル製の皿バネ本体52は、2つの層52b、52cからなる断面構造を有している。これらの層52b、52cは、相互に異なるそれぞれの熱膨張率を有する各金属の層であり、皿バネ本体52の脹らんだ側の層52bの方が窪んだ側の層52cよりも

熱膨張率が小さい。このため、皿バネ本体52の温度が上昇する程、脹らんだ側の層52bよりも窪んだ側の層52cの方が伸長し、両者の差が大きくなり、この皿バネ本体52の温度が予め定められたレベルに達すると、この皿バネ本体52が反転する。

【0044】なお、バイメタルには、2層だけでなく、3層のものがあるので、これを適用しても構わない。

【0045】この皿バネ51は、図5に示す安全装置12及び図8に示す安全装置31における皿バネ1の代わりに適用することができる。この場合、過充電又は短絡状態となって、電池ケース14内の圧力が上昇したときだけでなく、発電要素13の発熱により、この皿バネ51の温度が上昇したときにも、この皿バネ51が反転して、二次電池11の通電経路が切断され、電流が遮断される。

【0046】したがって、この皿バネ51を適用した二次電池11においては、PC T板による過電流の抑制、圧力上昇もしくは温度上昇にตอบสนองしての皿バネ51の反転による通電経路の切断、及び合成樹脂フィルム53及びアルミ箔54の破壊による内部ガスの放出によって、この二次電池11の防爆が行われる。

【0047】なお、上記各実施形態の皿バネは、その孔を塞ぐために、金属箔と合成樹脂フィルムを貼り合わせたものを用いているが、これに限定されず、適宜の圧力によって破れる他の材質のものを適用しても構わない。例えば、合成樹脂製の薄膜フィルムの適用が考えられる。

【0048】

【効果】以上説明したように、この発明の安全装置用の皿バネは、孔を有し、この孔をシートによって塞いでなるものであって、例えば二次電池の安全装置に適用され、通電経路に挿入されたスイッチの切換えと、ガスの排出という2種類の役目を果たすので、この安全装置の構造の簡単化を可能にする。

【図面の簡単な説明】

【図1】この発明の皿バネの第1実施形態を示す斜視図

【図2】図1の皿バネを示す断面図

【図3】図1の皿バネの変形例を部分的に拡大して示す断面図

【図4】図1の皿バネが適用される安全装置を備える二次電池を示す断面図

【図5】図4の安全装置を示す断面図

【図6】図4の安全装置の作用を説明するために用いた図

【図7】図4の安全装置の他の作用を説明するために用いた図

【図8】図1の皿バネが適用される他の安全装置を示す断面図

【図9】図8の安全装置における接片を示す斜視図

【図10】図8の安全装置におけるバネ押しを示す斜視

図

【図11】図8の安全装置の作用を説明するために用いた図

【図12】図8の安全装置の他の作用を説明するために用いた図

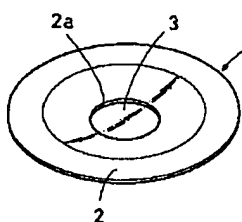
【図13】この発明の皿パネの第2実施形態を示す断面図

【符号の説明】

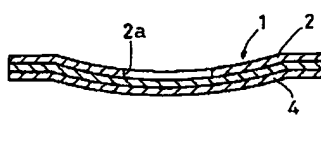
1, 51 皿パネ  
2, 52 皿パネ本体  
3, 53 合成樹脂フィルム  
4, 54 アルミ箔  
11 二次電池  
12, 31 安全装置  
13 発電要素

14 電池ケース  
15, 39 絶縁体  
17, 32 導体ケース  
18, 33 ガasket  
19 スペース  
21, 34 PTC板  
22, 35 環状端子  
23, 36 絶縁シール  
24 移動片  
25, 38 接片  
26, 37 電極蓋  
29, 42 端子  
30 リード線  
41 バネ押し

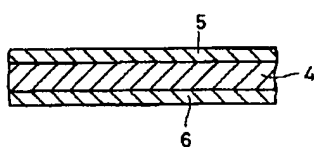
【図1】



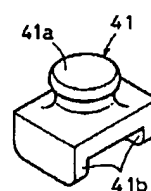
【図2】



【図3】

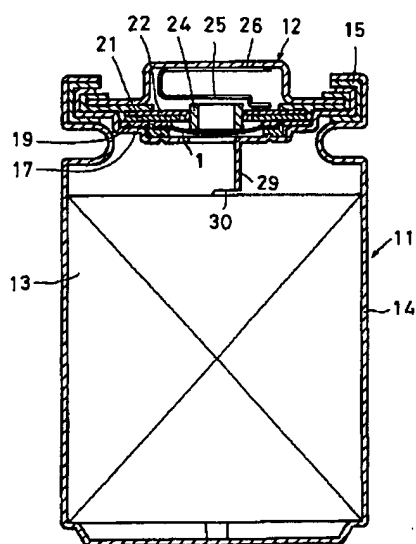


【図10】

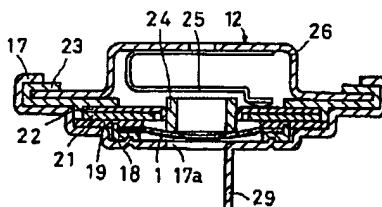


【図5】

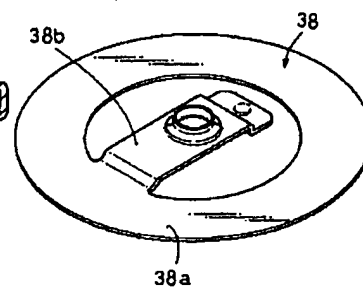
【図4】



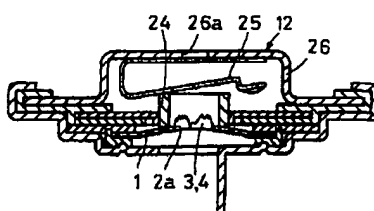
【図6】



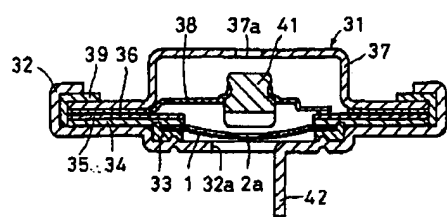
【図9】



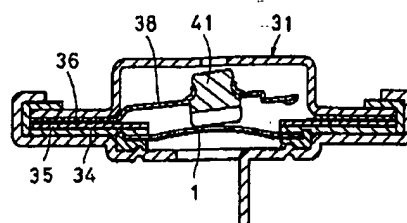
【図7】



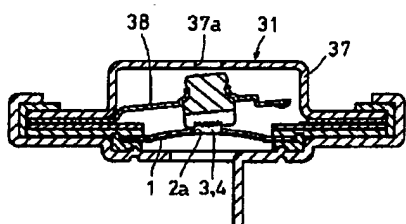
【図8】



【図11】



【図12】



【図13】

